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PROGRAM UPDATING SYSTEMS

CLAIM(S)

1) The program updating system of the present invention comprises: an upper station that sends an updated program and its program version; a base station that receives said updated program and its version to operate by said updated program; said program updating system being characterized by that said base station comprises: a central memory device for storing said updated program and its program version received from said upper station; multiple control devices, each of which receives said updated program and its program version and operates by said updated program; and a central control device that receives said updated program and its program version from said upper station, stores them in said central memory device, and sends said updated program and the version of this program to the control device among said multiple control device that has the preliminarily stored

program and version for operating the control devices 3 different from the version of the updated program stored in said central memory device.

2) Each of said multiple control devices in the program updating system of the present invention comprises: a data reception/transmission section for sending and receiving data to and from said central control device; a memory device for storing an initiating program for initiating said control device, an application program for operating the control device, and its program version; a control section that executes said initiating program, rewrites the application program and its program version preliminarily stored in said memory section with the updated program and its program version received by said data transmission/reception section when said data transmission/reception section received said updated program and its program version from said central control device, executes this rewritten program, and operates said control device.

3) A program updating system, as cited in Claim 1 or Claim 2, wherein said memory section is a rewritable ROM.

4) A program updating system, as cited in Claim 1 or Claim 2, wherein said data transmission/reception section is a RAM, into/out of which said control section and said central processing device can input/output data.

DETAILED DESCRIPTION OF THE INVENTION

(0001)

(Technical Field of the Invention)

The present invention pertains to a program updating system, particularly to the program updating system, wherein a base station receives a program sent from an upper station and updates an operation program in the base station to the program received.

(0002)

(Prior Art)

The prior art program updating system of this type is used to change the operation programs in multiple control devices each having a different function and being installed in the base station of a digital mobile communication system.

(0003)

In the prior art system, when the operation program of the control device installed in the base station needs to be changed, the changed operation program was preliminarily stored in a non-rewritable ROM or in a ROM such as an EPROM, wherein the stored data were erased by ultraviolet ray radiation and electrically rewritten, and after preparing the necessary number of these ROMs, the ROMs were delivered to the base station and the former ROM was manually replaced with this ROM.

(0004)

(Problems of the Prior Art to Be Addressed)

With the aforementioned prior art program updating system, when the operation program in the control device installed in the base station was changed, the changed program was preliminarily stored in the non-rewritable ROM or in the ROM, such as an EPROM, and the necessary number of these ROMs was prepared, which was very time consuming. In addition, multiple control devices each having a different function are installed in the base station, so multiple ROMs, in each of which is stored the operation program with a different function, need to be preliminarily prepared when the operation programs of multiple control devices are simultaneously updated, so managing the number of ROMs and their types was very time consuming. In addition, the ROMs, each of which is prepared by storing the changed operation program, were delivered to the base station at different locations, so it took long time before the ROMs arrive to the base stations. Moreover, the prepared ROMs were manually exchanged with the former ones to install in the base station, so there was a risk of bending the ROM's foot at the time of exchanging and there was a chance of causing an erroneous operation by defective contact even if the ROM was safely inserted.

(0005)

The present invention, to solve the aforementioned problems, attempts to present a program updating system that does not require preparing the ROMs in which are stored the changed operation programs and does not require carrying them to the base stations to manually install them.

(0006)

(Means to Solve the Problems)

The program updating system of the present invention comprises: an upper station that sends the updated program and its program version; and a base station that receives said updated program and its version to operate by said updated program. Said base station comprises: a central memory device for storing said updated program and its version received from said upper station; multiple control devices, each of which receives said updated program and its version and operates by using said updated program; and a central control device that receives said updated program and the version of this program from said upper station, stores them in said central memory device, and sends said updated version and the version of this program to the control device(s) whose preliminarily stored program and version for operating the control devices 3 are different from the version of the updated program stored in said central memory device 5, among said multiple control devices 3.

(0007)

Each of said multiple control devices in the program updating system of the present invention comprises: a data reception/transmission section for sending and receiving data to and from said central control device; a memory device for storing an initiating program for initiating said control device, an application program for operating the control device, and its program version; a control section that executes said initiating program, rewrites the application program and its program version preliminarily stored in said memory section with the updated program and its program version received by said data transmission/reception section when said data transmission/reception section received said updated program and its program version from said central control device, executes this rewritten program, and operates said control device.

(0008)

The embodiment example of the present invention is explained below with reference to the figures.

(0009)

Fig. 1 shows a block diagram of the program updating system as one embodiment example of the present invention,

(0010)

This example shown in Fig. 1 comprises the upper station 1 for sending the updated program and its program version and the base station 2 for receiving said updated program and said version and for operating by said updated program. Said base station 2 comprises the central memory device 5 for storing said updated program and the version of this program received from said upper station 1, multiple control devices 3 for receiving said updated program and the version of this program stored in said central memory device 5 and for operating by said updated program (the first control device 3_1 – nth control device 3_n. Generally, the number of these devices is 13, but the number is not specifically limited and it can be determined according to the necessary processing speed of the system.), and the central control device 4 that receives said updated program and the version of this program, stores them in said central memory device 5, and sends said updated program and the version of this program to the control device(s) 3 whose preliminarily stored program and version for operating the control devices 3 is different from the version of the updated program stored in said central memory device 5, among said multiple control devices 3.

(0011)

Each of said multiple control devices 3 comprises: the data transmission/reception section 8 (hereinafter referred to as a DPRAM 8), which sends and receives data to and from said central control device 4 and which consists of DPRAM, in/out of which data can be input/output by both said control device 3 and said central control device 4; the memory section 8 consisting of ROM, such as an electrically rewritable flash ROM, for storing said initiating program for initiating said control device 3, the application program for operating the control device 3, and the version of this application program; control section 6 that executes said initiation program, rewrites the application program and its program version preliminarily stored in said memory section 7 with said updated program and the version of this updated program received by said DPRAM 8 when said data transmission/reception section 8 received said updated program and its program version from said central control device 4, executes this rewritten program, and operates said control device 3.

(0012)

The operation of the program updating system of the present invention is explained in detail below with reference to Fig. 2.

(0013)

With reference to Fig. 1, the upper station 1 sends to the base station 2 the updated program updated from the application program for the control device 3 (the mth control device 3_m. m=1 – n.) that needs to update and operate the application program in the base station 2, along with the version of this updated program (S1).

(0014)

The central control device 4 in the base station 2 receives this updated program and its program version, copies them to the mth storage area 9_m in the central memory device 5, wherein the application program and its program version preliminarily stored in each of control devices 3 to operate multiple control devices 3 in the base station are preliminarily stored in multiple storage areas 9 corresponding to these control devices 3 (S2), respectively, outputs a reset signal to the signal line, and resets all the control devices 3 in the base station 2 (S3).

(0015)

Each control section 6 of multiple control sections installed in each of multiple reset control devices 3 executes the initiating program stored in the memory section 7 in the control device 3 having a self-control section 6 to conduct the initiation process, such as initiating this control device 3 and inspecting the memory device 7, and inputs the "initiation request" command and the application program and its version stored in the memory section 7 of control device 3 in the DPRAM 8 of this control device 3, to request the central control device 4 to initiate the operation of this control device 3 (S4, S5).

(0016)

The control device 4 searches the DPRAMs 8 of multiple control devices 3 to detect the control device 3 into which the "initiation request" command was input, selects one control device out of them, outputs the application program and its version input in the DRPAM 8 of the selected control device 3, selects the version of the program stored in the storage area 9 in the central memory device 5 that corresponds to the selected control device 3 (S6), and compares these two versions (S7). When these two versions do not concur as a result of the comparison, the control device 4 inputs in the mth DPRAM 8 in the mth control device 3_m the program and its version stored in the mth storage area 9_m in the central memory device that corresponds to the control device (the mth control device 3_m in this example) selected in step 6 (S6), inputs the "input instruction" command to input this program and its version, and continues the control in step 13 (S13).

(0017)

Subsequently, the mth control section 6_m in the mth control section 3_m detects the "input instruction" command input in the step 8 (S8) from the mth DPRAM 8_m, copies the program and its version input in the mth DPRAM 8_m to the mth memory section 7_m, updates the application program and its version (S9), executes this application program, and begins to operate the mth control device 3_m (S10).

(0018)

When the result of comparison in step 7 (S7) indicates the concurrence, the central control device 4 inputs in the DPRAM of the control device selected in said step 6 (S6) (the control device other than the mth control device 3_m, e.g., hypothetically pth control device) the "execution instruction" command to execute the application program stored in the pth memory section of this control device (S11), and continues the control in step 13.

(0019)

Subsequently, the control section of the pth control device detects the "execution instruction" command input in step 11 (S11) from the pth DPRAM, executes the application program stored in pth memory section, and begins to operate the pth control device (S12).

(0020)

Subsequently, the central control device 4 checks out if all the control devices 3 have completed the "initiation request" command process (S13). If the result of checking does not indicate the completion, the device 4 moves to said step 6 (S6) to continue the control. If the result of said checking indicates the completion, the device 4 ends the program updating operation here.

(0021)

The above explanation was given by assuming that there is one control device that needs to update the application program. When there are multiple control devices 3 that need to update the application program, the upper station 1 sends the updating program and its program version corresponding to the control device 3 to the base station 2. The central control device 4 in the base station 2 receives the updated program and its program version, stores them in each storage area 9 in the central memory device 5 that corresponds to each control device 3, and resets all the control devices 3 in the base station 2.

(0022)

(Advantage)

As explained above, according to the program updating system of the present invention, the base station 2 receives the updated program preliminarily changed from the operation program sent by the upper station 1 and its program version. When this version does not concur with the version of the operation program in the base station 2, the base station 2 rewrites the operation program stored in the rewritable ROM, such as a flash ROM, of the base station with the updated program, executes the rewritten program, and operates. Therefore it is not necessary to prepare the ROM in which is stored the changed program and to handle the number of ROMs and their types, which saves time of preparing and handling the ROMs. In addition, an updated program can be set in the base station 2 without a manual operation, so the time it takes for setting the updated program in the base station can be eliminated, and there is no chance of erroneous operation by defective contact.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a block diagram of the program updating system as one embodiment example of the present invention.

Fig. 2 shows a flow chart of one operation example of the system of the present invention.

1. upper station
2. base station
3. central device
4. central control device
5. central memory device
6. control section
7. memory section
8. data transmission/reception section (DPRAM)

3_1. first control device

3_m. mth control device

3_n. nth control device

6_1. first control section

6_m. mth control section

6_n. nth control section

7_1. first memory section

7_m mth memory section

8_1. first data transmission/reception section (first DPRAM)

8_m. mth data transmission/reception section (mth DPRAM)

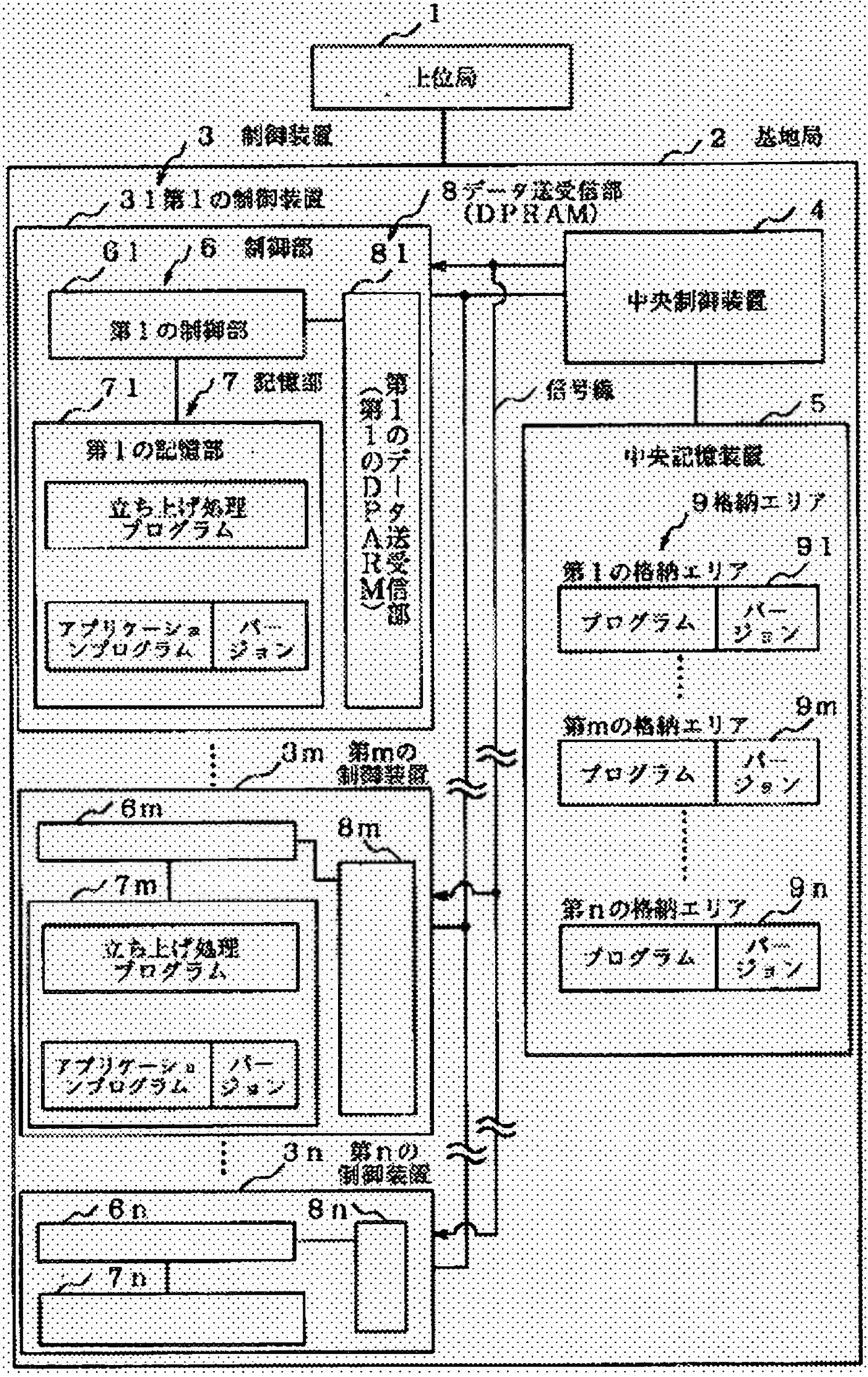
8n. nth data transmission/reception section (nth DPRAM)

9_1. first storage area

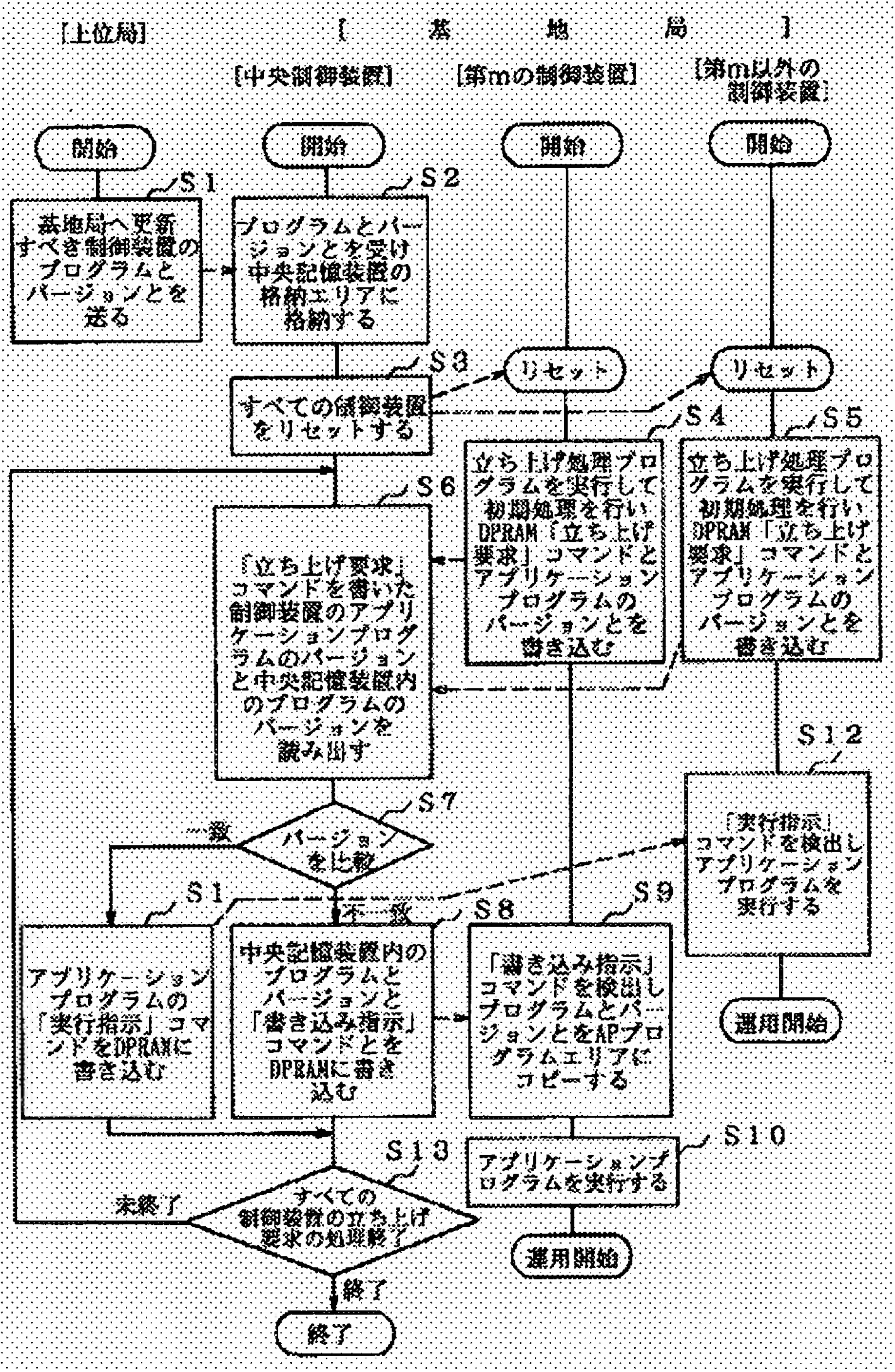
9_m. mth storage area

9_n. nth storage area

【図1】


1
上位局
3 制御装置
2 基地局
31 第1の制御装置
8 データ送受信部 (DPRAM)
4
中央制御装置
61
6 制御部
81
第1の制御部
71
7 記憶部
第1の記憶部
立ち上げ処理プログラム
アプリケーションプログラム
バージョン
第1のデータ送受信部（第1のDPRAM）
信号線
5
中央記憶装置
9 格納エリア
91
第1の格納エリア
プログラム
バージョン
9m
第mの格納エリア
プログラム
バージョン
3m 第mの制御装置
6m
8m
7m
立ち上げ処理プログラム
アプリケーションプログラム
バージョン
9n
第nの格納エリア
プログラム
バージョン
3n 第nの制御装置
6n
8n
7n

【図2】


[上位局]
[基地局]
[中央制御装置]
[第mの制御装置]
[第m以外の制御装置]
開始
開始
開始
開始
S1
基地局へ更新すべき制御装置のプログラムとバージョンとを送る
S2
プログラムとバージョンとを受け中央記憶装置の格納エリアに格納する
S3
すべての制御装置をリセットする
リセット
リセット
S4
立ち上げ処理プログラムを実行して初期処理を行いDPRAM「立ち上げ要求」コマンドとアプリケーションプログラムのバージョンとを書き込む
S5
立ち上げ処理プログラムを実行して初期処理を行いDPRAM「立ち上げ要求」コマンドとアプリケーションプログラムのバージョンとを書き込む
S6
「立ち上げ要求」コマンドを書いた制御装置のアプリケーションプログラムのバージョンと中央記憶装置内のプログラムのバージョンを読み出す
S7
バージョンを比較
一致
不一致
S12
「実行指示」コマンドを検出しアプリケーションプログラムを実行する
運用開始
S1
アプリケーションプログラムの「実行指示」コマンドをDPRAMに書き込む
S8
中央記憶装置内のプログラムとバージョンと「書き込み指示」コマンドとをDPRAMに書き込む
S9
「書き込み指示」コマンドを検出しプログラムとバージョンとをAPプログラムエリアにコピーする
S10
アプリケーションプログラムを実行する
運用開始
S13
すべての制御装置の立ち上げ要求の処理終了
未終了
終了
終了

Translations
U. S. Patent and Trademark Office
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Akiko Smith